MSE:

Mobile Subscriber Equipment

The articles which follow offer a detailed description of the operational, training and logistics support concepts for MSE preceded by some general information designed to provide a better understanding of the overall MSE program and its relationship to the Battlefield Communications Review.

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MSE: an overview

A past issue of the ARMY COMMUNICATOR included a short article on the MSE architecture and some general background information pertaining to the Battlefield Communications Review (BCR). This issue offers a more detailed description of the operational, training and logistics support concepts for MSE preceded by some general information which will give the reader a better understanding of the overall MSE program and its relationship to the Battlefield Communications Review. Although there were many contributing factors, the single most important consideration that led the Signal Corps to reassess the course in which we were heading was the communications doctrine leg. The communications doctrine had not kept abreast of the tactical doctrine changes mandated by Airland Battle. The existing and emerging communications systems simply would not provide the tactical mobile force with the responsive C^3 capabilities needed to fight and win the Airland Battle. To be effective in combat, our commanders must have the means of exchanging critical information (VOICE and DATA) throughout the battlefield on a secure and time sensitive basis. Therefore, the future communication system must provide for rapid equipment emplacement, systems flexibility and reliability and survivability—both physical and electronic. We are convinced that MSE will do this.

The Mobile Subscriber Equipment System being pursued by the Army will provide the tactical forces with increased mobility through the use of mobile radiotelephones. Increased mobility and flexibility of command posts users (wire line subscribers) will be achieved through transparent (radio frequency) connectivity between CPs and the communications nodes rather than through the traditional wire and cable.

Since MSE is a total communications system, the functions of switching, radio access and trunking, communications security and systems control are integrated into a composite synergistic system. MSE will replace the existing command and area systems from the corps rear boundary to an area forward of the maneuver brigade with a common user area system. The system offers subscribers a means of communicating with each other on a discrete basis, using fixed directory number regardless of their location on the battlefield. There is no longer a requirement for users to know network connectivity information, such as PR and SL numbers of supporting switches. Subscribers need only know the permanent number of the called party or how to use deducive numbering charts to gain connectivity. The communications system literally locates the called party and completes the connection. How this is achieved is discussed in "MSE: the operational concept" on page 8 of this issue.

The MSE acquisition strategy is based on a non-developmental item (NDI) approach. Due to the complex nature of the system and the uniqueness of the NDI approach, the traditional required operational capability (ROC) document was not appropriate for specifying the user's requirements. Instead, an MSE operational capabilities document (MSEOCD) was developed for use, in conjunction with the previously approved JOR, as the source documentation. Additionally, the MSEOCD includes numerous desired features to enhance the operational utility of the MSE were they included in the selected system. Although many of these desired features may be inherent in the offerors' systems, they are not required as part of the MSE baseline system.

There are five functional areas included in the MSE baseline system. A brief description of each follows (see also figures 1 and 2).

Subscriber terminals: This functional area includes those user owned and operated telephone, facsimile and alpha numeric terminals necessary to input voice and data information into the MSE system. These terminals are allocated to combat, combat support and combat service support units operating throughout the tactical area of operation.

Mobile subscriber access: The Mobile Subscriber access function consists of the Mobile Subscriber Radiotelephone Terminals (MSRTs) which permit subscribers to automatically communicate secure voice and data throughout the tactical area of operation on a discrete address basis. The MSRT provides this service while mobile or stationary and is allocated to commanders and primary staff members of major units in the corps and division areas. MSRTs are mounted in or on tactical wheeled or tracked vehicles and may be dismounted and operated in other physical environments.

Wire subscriber access: This functional area provides concentrations of switched wire subscribers (CPs, for example) a means of access into the total MSE system. Wire subscriber terminal users can communicate secure voice and data traffic on an automatic, discrete address basis to all other wire and mobile subscribers throughout the tactical area of operation. This functional element will be owned and operated by the Signal support units: Corps Signal brigades and division Signal battalion.

Area coverage: This functional area consists of a digital network of communications nodes that permit radio access by subscribers of both the mobile subscriber and wire subscriber access functional area. This capability is provided to subscribers throughout the tactical area of operation. The network of nodes is owned and operated by the corps and division Signal support units.

System control: This functional area provides the necessary control equipment that enables Signal personnel to manage and control the MSE system on a corps-wide basis. The sys-

tem control element is owned and operated by Signal support units as listed in the wire subscriber and area coverage functional elements.

The MSE System has been designated a major acquisition program with program management responsibility originally assigned to PM, Multi-Service Communications System (PMMSCS) and recently reassigned to PM, Army Tactical Communications System/Mobile Subscriber Equipment (PM, ATACS/MSE).

The MSE train is moving fast. The request for proposal for acquisition of the total system has been completed and was released to industry on 2 July 1984. The present plan calls for contract award, for the basic contract during mid-FY 85, with equipment deliveries beginning in FY 87.

It should be emphasized that the information presented within this article is based solely on a notional MSE system architecture with concepts developed by the United States Army Signal School and does not necessarily reflect the actual hardware solution of the ultimately chosen MSE system.

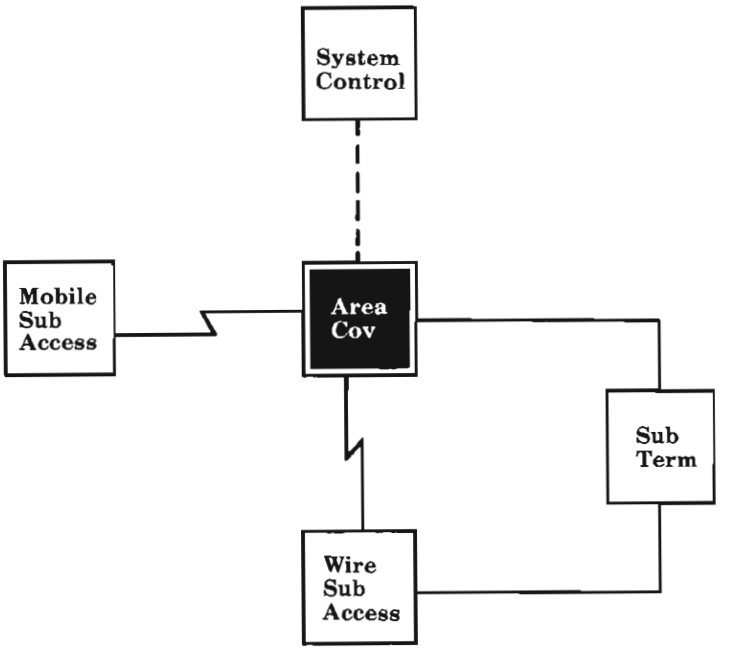

Figure 1. Functional MSE

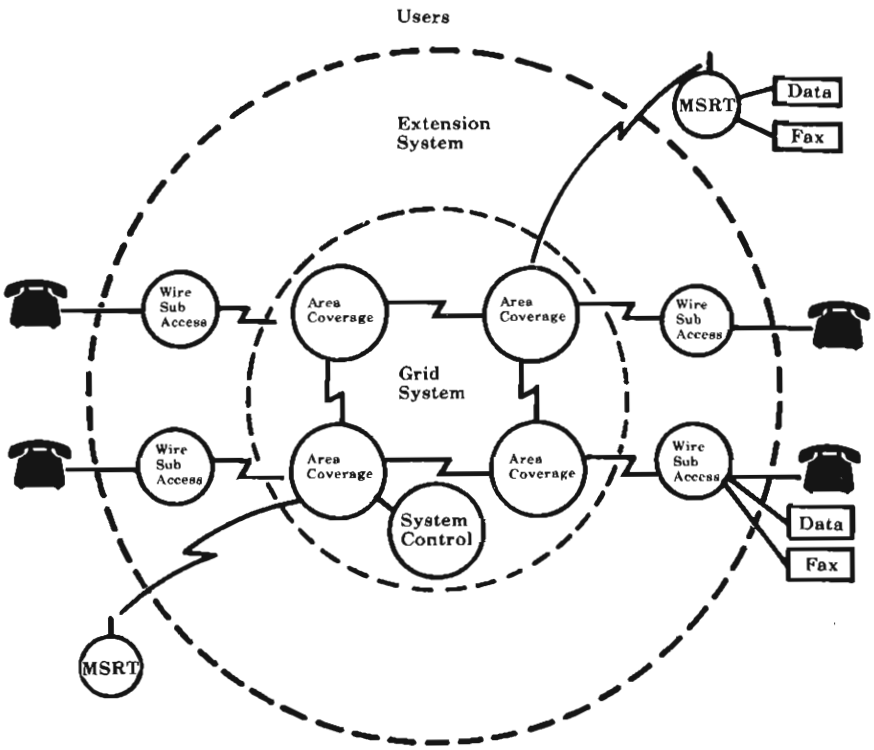

Figure 2. MSE System Architecture

MSE will be much easier to deploy...because it requires significantly fewer sorties and each communications assemblage will roll on or off strategic aircraft.

MSE: the operational concept

In the post 1986 time frame, the Mobile Subscriber Equipment (MSE) system will replace the existing mix of INTACS and ATACS communications systems in the corps and divisions. Fielding of MSE will be on a corps slice basis with one corps being fielded about every 14 months. The MSE system will satisfy the modern battlefield requirements for a common user system providing secure mobile communications, rapid displacement, system flexibility, reliability and survivability. The MSE will be much easier to deploy to the battle zone because it requires significantly fewer sorties and each communications assemblage will roll on/off of strategic aircraft.

Since the MSE system will be deployed as an integrated corps and divisions communications system, its operational concept will be discussed with an overview of the entire backbone network and then by addressing echelon peculiar operations. For the basis of discussion, a notional five division corps employment will be used.

Network overview

The backbone of the five division corps network is composed of up to 56 interlinked nodes. Thirty-six nodes are deployed by the corps Signal brigade and four by each division Signal battalion. Typically node separation will be about 25 Km's with each node connected via RF trunking to four other nodes forming the grid network (backbone system) for a 37,500 sq Km corps battle zone. Diagrams of a typical node and a complete corps MSE system are at Figures 1 and 2.

Nodes are deployed from the corps rear boundary forward to the maneuver brigade area based on geographical and subscriber density considerations. Realistically it is unlikely that all 56 nodes will be operational at any given time even in a relatively static situation, nor will the subscriber population be evenly distributed over the battlefield. In addition, geographical considerations normally will not

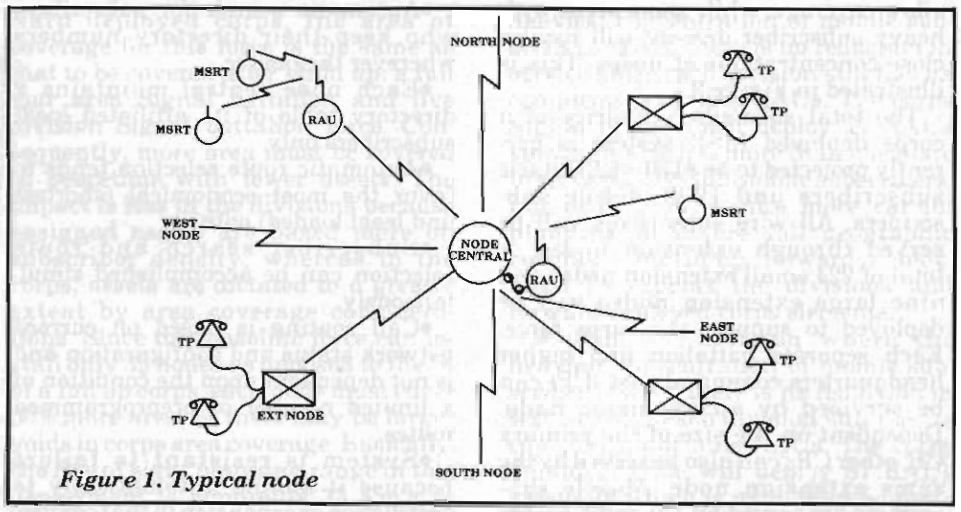

Figure 1. Typical node

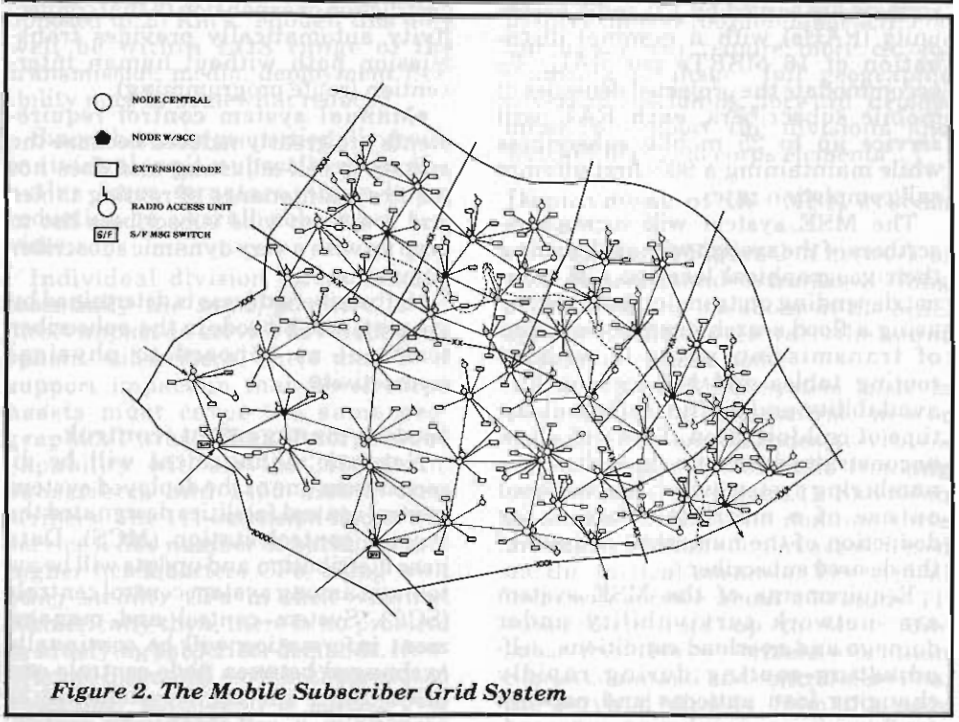

Figure 2. The Mobile Subscriber Grid System

allow coverage, while some areas with heavy subscriber density will require close concentrations of nodes. This is illustrated in Figure 2.

The total subscriber capacity of a corps deployed MSE system is currently projected to be 8100—6200 static subscribers and 1900 mobile subscribers. All wire subscribers will be served through extension nodes. A total of 224 small extension nodes and nine large extension nodes will be deployed to support the corps force. Each separate battalion and higher headquarters command post (CP) can be serviced by an extension node. Dependent on the size of the primary CP, other CPs can also be served by the same extension node. Mobile subscribers are served by 121 radio access units (RAUs) with a nominal distribution of 16 MSRTs per RAU. To accommodate the projected densities of mobile subscribers, each RAU will service up to 25 mobile subscribers while maintaining a 90% first attempt call completion rate.

The MSE system will locate subscribers of the system without knowing their geographical location and without depending on translation tables by using a flood search method. Selection of transmission paths is without routing tables and is based on link availability and traffic loading at the time of call initiation. This will allow unconstrained use of a fixed directory numbering system which can be based on use of a matrix(es) format for deduction of the numerical address of the desired subscriber.

Requirements of the MSE system are: network survivability under damage and overload conditions, self-adjusting routing during rapidly changing load patterns and network configurations, numbering independent from geographical location of subscribers and simplified automated system control.

Some of the advantages to be provided by the self-organizing features include:

- Automatic search for subscribers who keep their directory numbers wherever they move.
- Each node central maintains a directory table of its affiliated local subscribers only.
- Automatic route selection tends to favor the most economical (shortest and least loaded) path.
- Subscriber search and route selection can be accomplished simultaneously.
- Call routing is based on current network status and configuration and is not dependent upon the condition of a limited number of preprogrammed routes.
- System is resistant to failure because it adapts automatically to destruction or expansion in that connectivity automatically provides transmission path without human intervention (route programming).
- Manual system control requirements are greatly reduced because the system is self-adjusting and does not require maintenance of routing tables and a system-wide subscribers list to keep up with a very dynamic subscriber population.
- Subscriber address is determined by programmed bit code in the subscriber terminal as opposed to physical connectivity.

System management/control

Network management will be directed from one of the deployed system control central facilities designated the master control station (MCS). Data base distribution and update will be automatic among system control centrals (SCC). System control and management information will be continually exchanged between node centrals and SSCs. Since the MSE system will be essentially a self-organizing system, the SCC is more of a management focal point (command and control center) than a technical control center. The SCC's primary concern is with the distribution and management of nodal assets to satisfy a dynamic subscriber population.

There are two SCCs in the corps Signal brigade and two SCCs in each division Signal battalion. SCCs may be collocated with any node centrals in the network. Typically, one of the corps Signal brigade's SCCs will be designated the network MCS. The SCCs in the division Signal battalions give the divisions a stand-alone capability plus the ability to train independently. When installed as part of the integrated MSE system, these SCCs are operated in the slave mode.

Some of the key tasks to be performed by the management and control heirachy of the MSE system include data base preparation, trunking management and deployment and redeployment of node centrals and extension node assets. Key to maximizing serviceability and survivability of the network are the ability to react to unpredictable stimuli and careful preparation of contingency plans.

Advance preparation of the system database is possible by the selection of subset(s) of the system database corresponding to a selected force structure and deployment scenario which is then tailored by adding or deleting deployment peculiar data. This basic database preparation can be accomplished before deployment. Contingency planning requires that a variety of databases be prepared for implementation on short notice. Careful planning will significantly reduce reaction time and enhance system survivability.

System interfaces

The MSE system requires interfaces with a variety of communications systems. Interface is required to the EAC system, both dial and record traffic, to AUTOVON and to AUTODIN. Interfaces to NATO military, host nation commercial systems and to the combat net radio system must also be provided.

Flexibility in deployment of assets dictates that all node packages have certain interface capabilities. This is accomplished by providing a commercial switch interface capability at

all extension node switches and by providing a NATO interface capability in all node centrals. Initially, the NATO interface capability may be an analog interface designed IAW STANAG 5040. If so, it will be replaced by a secure digital interface, IAW applicable STANAGs in the 1990's.

If the MSE system requires a NATO interface at the EAC gateway for voice and record traffic (TRI-TAC equipment at EAC/foreign equipment at corps), it is obvious that the seven traffic channels provided by a node central's single STANAG 5040 interface device will not be sufficient. Development of a NATO interface facility (NIF) may be required. Two NIFs, one for each of two corps/EAC gateways, would be required. The corps/EAC interface must provide the capability for free flow of both voice and data traffic. It is through these gateways that corps subscribers will access DCS AUTOVON and AUTODIN systems as well as pass intertheater traffic.

Integrated system

As indicated previously, the MSE system is an integrated communications system controlled by a master control station. There is no finite line dividing the MSE system into corps and division communications systems. A division communications system exists only when a division is deployed initially or in a stand-alone mode. The dotted line in Figure 2 indicates a dividing line between corps Signal brigade owned assets and division Signal battalion owned assets. It does not represent a dividing line between communications systems. Just as the combat arms and combat support units deploy assets forward to support the division battlefield, so will the Signal brigade commander deploy his assets.

The active corps force which exists for peace time and at initiation of hostility typically consists of a three division force structure. The corps Signal brigade structure will consist of three active Signal battalions. Geographically, particularly for the forward deployed corps, the area of coverage for this force is the same as that to be covered after build up: a full four area Signal battalion and five division Signal battalion force. Consequently, more area must be covered in peacetime with fewer assets. The impact is less in the divisions because assigned assets are based more on subscriber density, whereas in the corps, assets are dictated to a greater extent by area coverage considerations. Since this baseline force can install only 39 nodes as opposed to the 56 of a full up corps, each node must cover 30% more area, or there may be larger voids in corps area coverage. Basically, the line of sight planning range in this deployment is nominally 33 Km's as opposed to 25 Km's. Though this may well be within LOS range of the transmission media, deployment flexibility may be somewhat reduced.

Since there are proportionally fewer individual/unit subscribers in the active force structure, there is no reduction in overall subscriber services.

Individual division forces remain essentially the same, so there is no direct impact on service to wireline telephone subscribers. There may be a support impact in that fewer corps assets must cover the same geographical area. The 27 corps node capability will service 3500 static subscribers and 1450 mobile subscribers. The 111-extension nodes will service a like number of battalion and higher headquarters CPs, along with other smaller CPs in their vicinity. Numerically then, there is no problem in satisfying subscriber demands. However, as discussed earlier, this reduced subscriber population is spread over essentially the same geographical area as would be the fully activated corps force structure, thus requiring much more careful planning for asset distribution and connectivity—including deployment of corps Signal brigade assets to support division operations.

Within the division where the heaviest concentration of mobile subscribers exists, there is no reduction in service since each division still has its complement of nine RAUs. The corps Signal brigade will deploy 57 RAUs versus 76 which is more than adequate to serve the 600-700 mobile subscribers, but again will require more careful planning to insure full geographic coverage, including forward deployment to support the divisions and forward deployed corps elements.

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Deployment of the MSE system node

As shown in Figure 2, a network of node centrals, tandem trunk switching points form the backbone of the MSE system. Each node central is the hub of a communications node.

The typical MSE system node is composed of the node central, three or more small extension nodes, two RAUs and a complement of radio trunking assemblages (see Figure 1). Extension node assets above the nominal three are deployed from support assets based on the tactical scenario. The typical node will service about 100 static TP subscribers and up to 50 mobile subscribers. No subscribers, other than Signal command and control elements, are serviced directly from the node central.

The node central is deployed based on the deployment locations of the serviced CPs (extension nodes), topographic considerations (LOS requirements) and network (grid interconnectivity) requirements. Each node central will have the capability to

tandem switch at least 12 trunk groups. Trunk groups not utilized in the role of parent node central are utilized in a role of alternate node central for key CP extension elements. Figure 3 diagrams a node central in a typical deployment.The transmission media is provided by three like configurations of four radios each or equivalent function. Each radio is equipped with multiple band cap ability to allow it to terminate either internode links to other node centrals or to intranode links to extension nodes. The two assemblages of the node central, the three radio assemblages and platoon support vehicles are co-sited (see Figure 4). Connectivity from the node central to radio assemblages is via short cable links. Radios must be carefully sited using sound engineering principles to allow proper antenna dispersion and connectivity. The limited local termination capability is used for Signal element command and control functions.

Extension node assets are deployed as the access points for static TP subscribers, generally in support of battalion or higher headquarters CPs and up to several support company CPs. It follows then that the primary consideration in the siting of the extension node is the location of the supported unit CP or CP grouping (several small CPs). Although it is not dictated, the transmission media for the extension node is envisioned as LOS radio. The radio assemblage will contain two stacks of radios, one for primary connectivity and one for alternate connectivity or redundancy. Therefore, connectivity to the radio assemblage, which must have LOS to the node central radio(s), is also a siting consideration. No extended cable links are provided for. Subscribers must provide their wire line connectivity to a junction box in the vicinity of the extension node. The extension node crew can extend two junction box access points up to 1000 feet from the switch. To reduce wireline lengths and

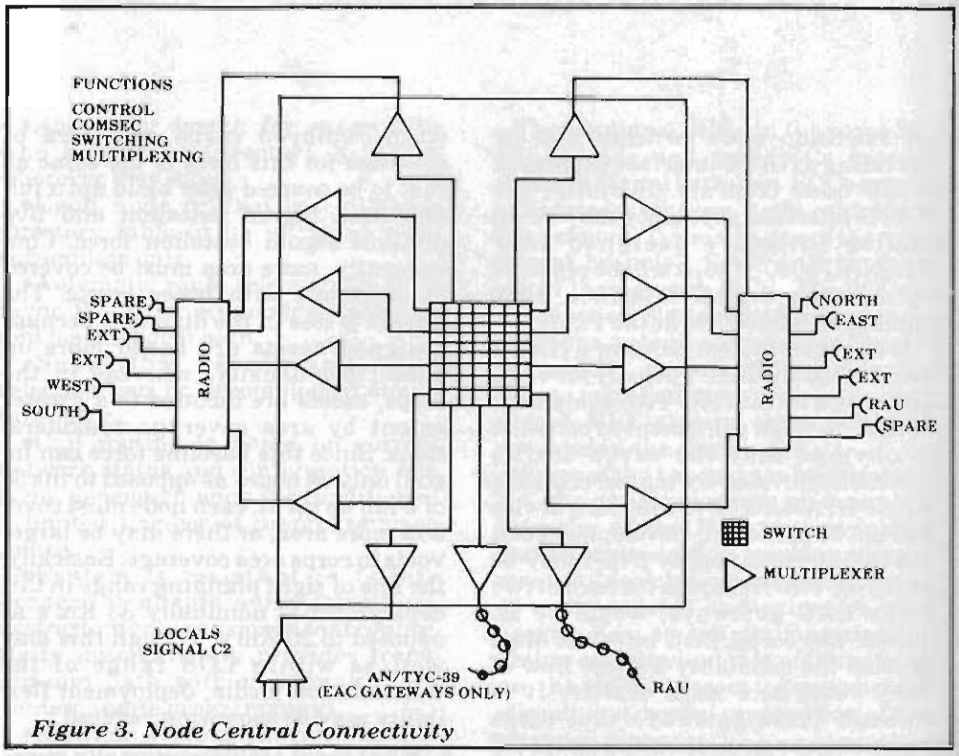


Figure 3. Node Central Connectivity

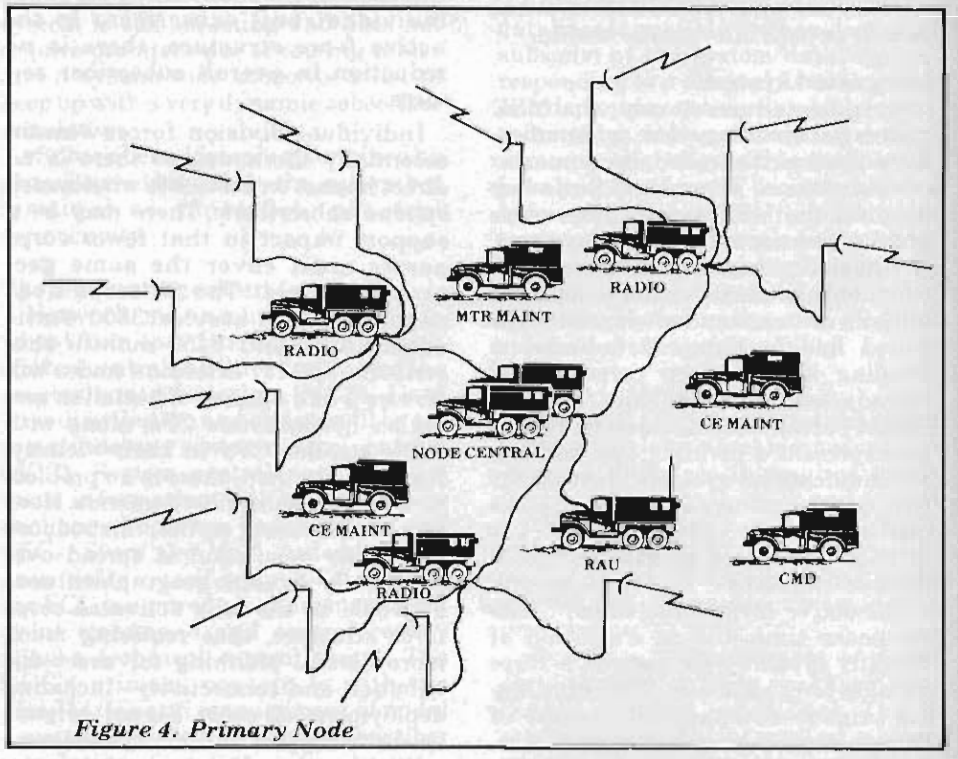


Figure 4. Primary Node

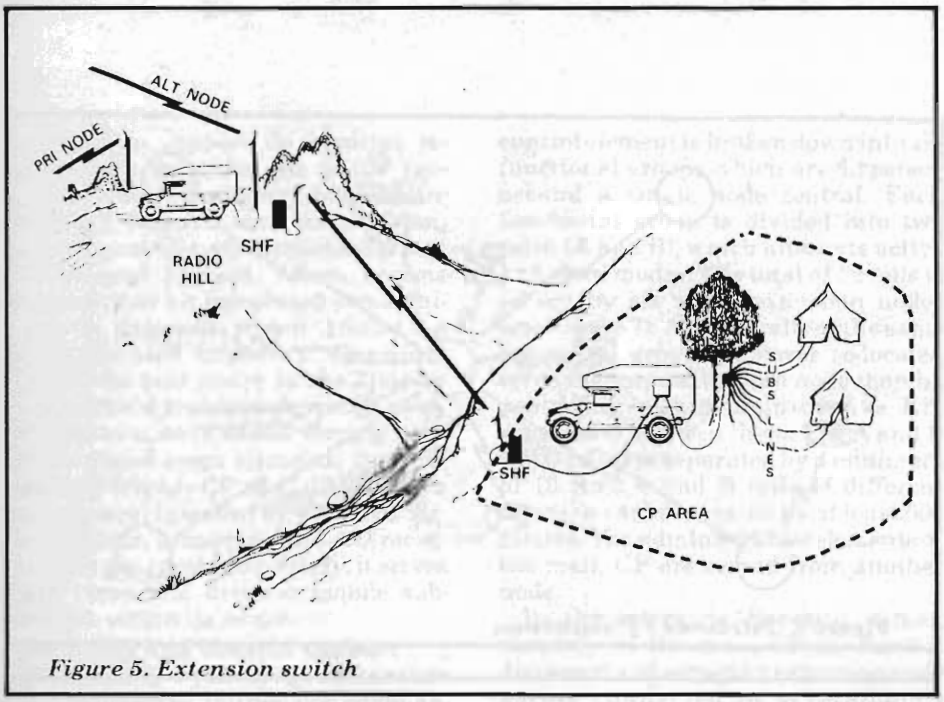


Figure 5. Extension switch

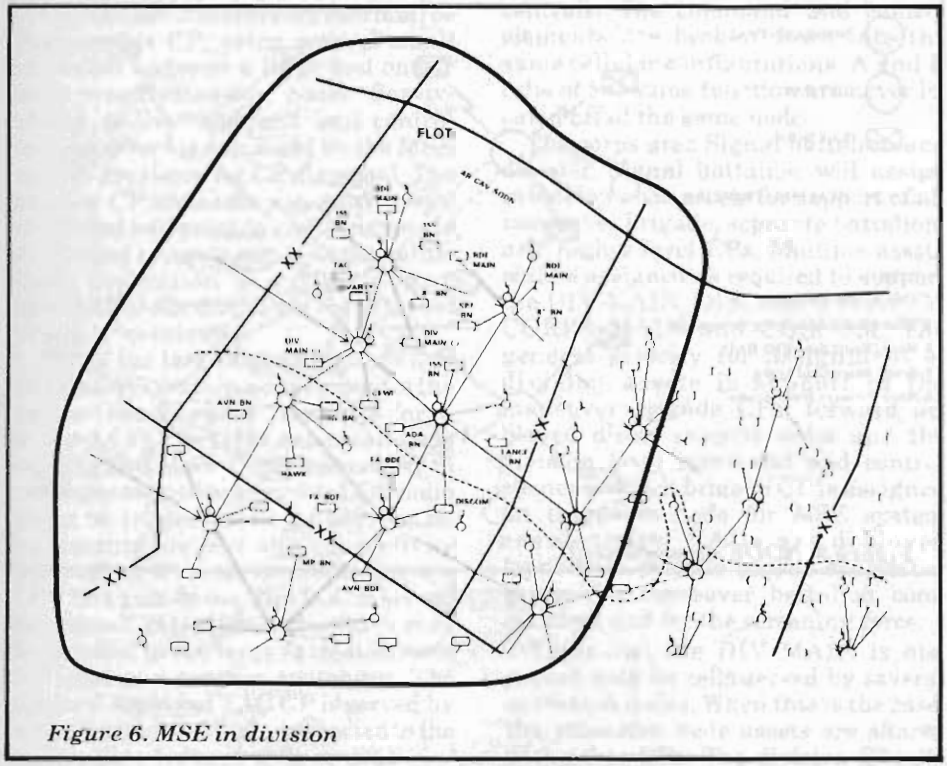


Figure 6. MSE in division

increase convenience to the subscriber, a down-the-hill radio capability is desired. This will also enhance CP security by taking the radio signature out of the CP. This capability can be provided by a low power SHF LOS link with a range of five to eight Km. These throw on the ground transceivers will be transported in the extension node switch and radio assemblages. The transceivers can be remoted up to 500 feet from their associated elements.

The large extension node is provided to give the commander the option of massing the main or support command CP. One large extension node is provided by each corps area and division Signal battalion. The crew can extend six junction box access points up to 1000 feet from the switch. Deployment considerations are essentially the same except that dual active radio links are provided with connectivity to two node centrals (see Figure 5).

Each area platoon can deploy two RAUs. One RAU is always located with the node central to provide basic geographical coverage. The other RAU is deployed within the node's general area of coverage to fill LOS gaps in mobile subscriber service, or to meet additional service requirements in areas of high subscriber concentrations. The primary siting consideration for the second RAU, and its supporting LOS radio assemblage (same as discussed for extension mode) is to maximize the number of mobile subscribers served and yet remain within line of sight of the node central. The mobile communications range for the MSRT to RAU is typically 15 Km. This factor must be considered in deploying the RAU so as to support likely subscriber travel routes if total area coverage is not possible. In addition to these assets, each corps area and division Signal battalion has one RAU. This unit will normally be deployed with the large extension node, to support the heavy concentration of mobile subscribers found around a massed main CP. Alternatively, it will be deployed to

support any gaps in the battalion coverage: to support a forward deployed CAV element or held in reserve for such contingencies, for example. As mobile subscribers move beyond the area of coverage of one RAU into the area coverage of another RAU, reaffiliation is required. Reaffiliation is a relatively simple procedure requiring the subscriber to redial the desired subscriber number if an in-process call is broken by the mobile subscriber losing connectivity. Reaffiliation is transparent to the subscriber if it occurs between calls. It is a desired capability of the MSRT that a loss of connectivity indicator be provided which would alert the subscriber of the necessity to reaffiliate when he moves out of the affiliated RAU's range while a call is in process.

Division snapshot

It will be instructive to examine deployment of the MSE system in a division slice (refer to Figure 6). The division Signal battalion is provided with two system control centrals to enable it to fully support the division in a stand-alone mode. Depending on the tactical scenario, corps CE support elements are assigned to the division usually by platoon increments either by access switch platoons (with four small extension nodes), to increase nodal capacity, or by area node platoons, to provide additional nodes and capacity or some combination of both.

The division Signal battalion deploys an extension node forward in support of each maneuver brigade CP. Mobile subscribers down to maneuver battalion headquarters and forward deployed screening forces must be supported by forward deployment of an RAU. Depending on the division front, terrain and tactical scenario, and keeping in mind the 15 Km planning range for mobile communications and LOS requirements, forward deployment of an additional RAU may be required.

The division Signal battalion is

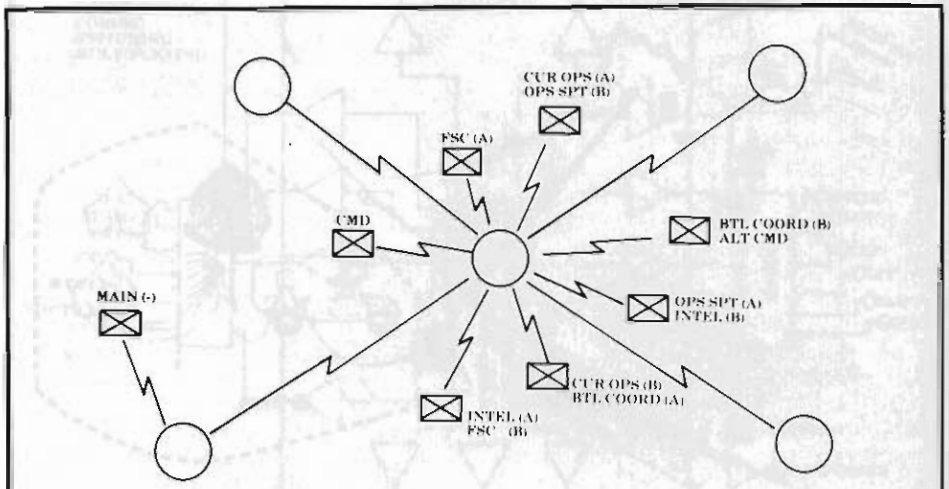


Figure 7. Intranode CP dispersion

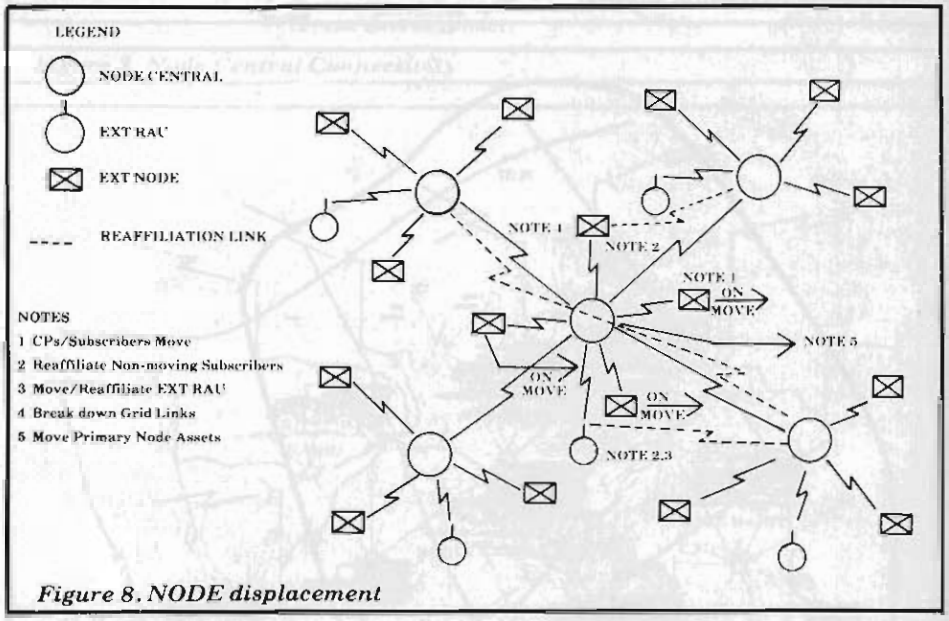


Figure 8. NODE displacement

equipped to support its baseline requirements only. As the battle progresses and corps support elements are deployed forward into the division, corps Signal brigade support must also be deployed forward. Assets become mingled into an integrated communications network which knows no corps/division boundary. Examination of the rear nodes in the division geographical area reveals connectivity of extension node assets serving both division and corps elements, the field artillery brigade CP and DISCOM, to a node central installed by the corps Signal brigade. Likewise, the RAU recognizes no geographic boundary; it serves both corps and division mobile subscribers within its range.

Command and control support

The MSE system architecture affords the corps and division commander the option of dispersing (normal) or massing his CP, using several small extension nodes or a large and one or more small extension nodes. Survivability of the command and control infrastructure is enhanced by the MSE system provision for CP dispersal. The smaller CP elements are more easily concealed and provide an RF signature duplicated at many points on the battlefield. Separation of duplicate functional elements minimizes the threat of loss of C^2 continuity.

Use of the large extension node and two small extension nodes provides the subscriber support required for a massed CP. The large extension node serving the main CP is connected to two separate nodes by active LOS radio links to insure grade of service requirements are met and connectivity maintained if a node central is lost or a LOS link goes down. The TOC is served by a small extension node which may be trunked to the large extension node for local and tandem switching. The forward deployed TAC CP is served by a small extension node connected to the appropriate forward node central.

In the intranodal dispersed CP option, the tactical command and control element is broken down into six functional groups which are dispersed around a single node central. Each functional group is divided into two cells, (A and B), which alternate active and sleep modes. The total of 12 cells is served by six small extension nodes (see Figure 7). A and B cells of the same functional group are never co-located off of the same extension node thereby providing a minimum of five Km separation between them. The A and B CMD cells are separated by a minimum of 10 Km. A and B cells of different functions are separated by at least 500 meters. The administrative elements of the main CP are served from another node.

In the internode dispersal option, elements of the main CP are further dispersed and served by extension node assets connected to several node centrals. The command and control elements are broken down into the same cellular configurations. A and B cells of the same function are never located off of the same node.

The corps area Signal battalion and division Signal battalion will assign extension node assets for support of all maneuver brigade, separate battalion, and higher level CPs. Multiple assets will be assigned as required to support the DIV MAIN, DISCOM, DIVARTY, CORPS MAIN and COSCOM. The general priority for assignment of division assets is support of the maneuver brigade CPs, forward deployed direct support units and the division level command and control elements. Each brigade CP is assigned an extension node for MSE system connectivity. RAUs are deployed forward to provide mobile subscriber access for maneuver battalion commanders and for the screening force.

Typically, the DIV MAIN is dispersed with its cells served by several extension nodes. When this is the case, the extension node assets are shared with other CPs. The division C^2 cells are free to move from switch to switch as required and their function is disguised by the resident CP functions. The DISCOM will typically be served by the large extension switch. The DISCOM signature is disguised by separation of the radio signature, connectivity to two separate node centrals, and by maximizing use of the radio separation capability (SHF link) and subscriber separation capability (multipair cable to junction points).

The corps Signal brigade is responsible for assignment of extension node assets to support the corps combat support and combat service support elements and the assigned division as required. In general, each separate battalion or higher level CP is provided an extension node for MSE system connectivity. Smaller units will tie in through one of these deployed extension nodes.

This discussion of dispersed CP applies to CORPS MAIN support. As in the division, when the cellular dispersed concept is used, the cells will share assets assigned to support other CP elements. The discussion of DISCOM support applies equally to the COSCOM.

Forward deployed corps elements will be supported by assets of the corps area Signal battalions. Connectivity in the transition zone where corps and division assets may overlap is provided to maximize system balance, without regard to equipment ownership, as directed by the corps systems control.

Node displacement

In a dynamic network, frequent displacement of nodes may be required. Careful planning and execution is required in order to minimize disruption of subscriber service. The most likely cause of node displacement is a shift in subscribers (CPs). Ideally, node displacement should occur when all or most of its subscribers are also displacing. The ideal will seldom occur. There will be some CPs whose mission does not require their concurrent displacement and whose total communications requirements cannot be met by MSRT capabilities. Node displacement

should generally follow these steps (see Figure 8):

•Subscriber reaffiliation: the first step is to minimize disruption of services by moving when the least number of subscribers will be affected. Others must be reaffiliated. Some extension nodes which are moving in support of major CPs may leave some smaller CPs (companies, detachments) without switch service. These must be notified in time to allow a change of CP location and switch affiliation if possible. Some extension nodes serving medium (battalion, brigade) CPs will not move and must be reaffiliated, with minimum disruption, to another node central. If LOS assets have been properly sited, this normally requires only activation and switch over to another radio stack and antenna.

•If required, the extension RAU should be relocated to maximize coverage for those CPs remaining in the geographical area. If mobile service can be adequately maintained by RAU assets of the surrounding nodes, the RAU LOS link can be broken down and the RAU node prepared for movement.

•Having satisfied subscriber requirements, break down the intra and inter node links and disestablish the node.

•Move and reestablish the node.

Communications security (COMSEC)

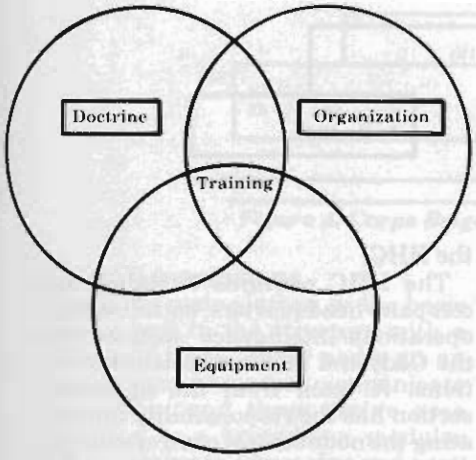
All RF links in the MSE system will be encrypted to provide security of voice and data traffic classified through SECRET level. This includes single channel links between the RAU and MSRTs as well as trunks between nodes which will be bulk encrypted. Subscriber wire line loops will be physically secured. Subscribers requiring end-to-end encryption for passing TOP SECRET and/or SPECIAL INTELLIGENCE traffic will provide approved encryption devices at the terminals.

Relative to earlier systems, security of the MSE system and/or the subscriber is enhanced by inherent deployment considerations. The greater dispersal of users allowed by the greater number of like subscriber entry points results in lower and similar RF signature across the battlefield making it more difficult for the enemy to identify specific elements (functions) and to perform target analysis and selection. The inherent provision for mobile subscriber service reduces the value of switchboards as targets since they are not essential to the maintaining of vital command/control links. CP security is further enhanced by separation of the RF signature from the CP switchboard. The self-organizing nature of the MSE system coupled with the large number of nodes enhances network survivability and lessens the criticality of any specific node(s).

Included among other COMSEC features being pursued for the MSE system are the provisions for automatic random frequency selection of per call basis and the provision of automatic RF power level control for links between the RAU and MSRTs.

It should not come as a surprise that the approaches to MSE fielding, structure, personnel and training are not "business as usual."

MSE: fielding, structure, personnel, training



MSE Force Integration

My intention here is to outline many of the ideas on MSE fielding, structures, personnel and training generated during the IPR.

While much work has been accomplished, a lot of details have yet to be finalized. Some can't be totally completed until the system is selected, others are still being negotiated with the principal commands and agencies. The descriptions below represent today's framework for our MSE future.

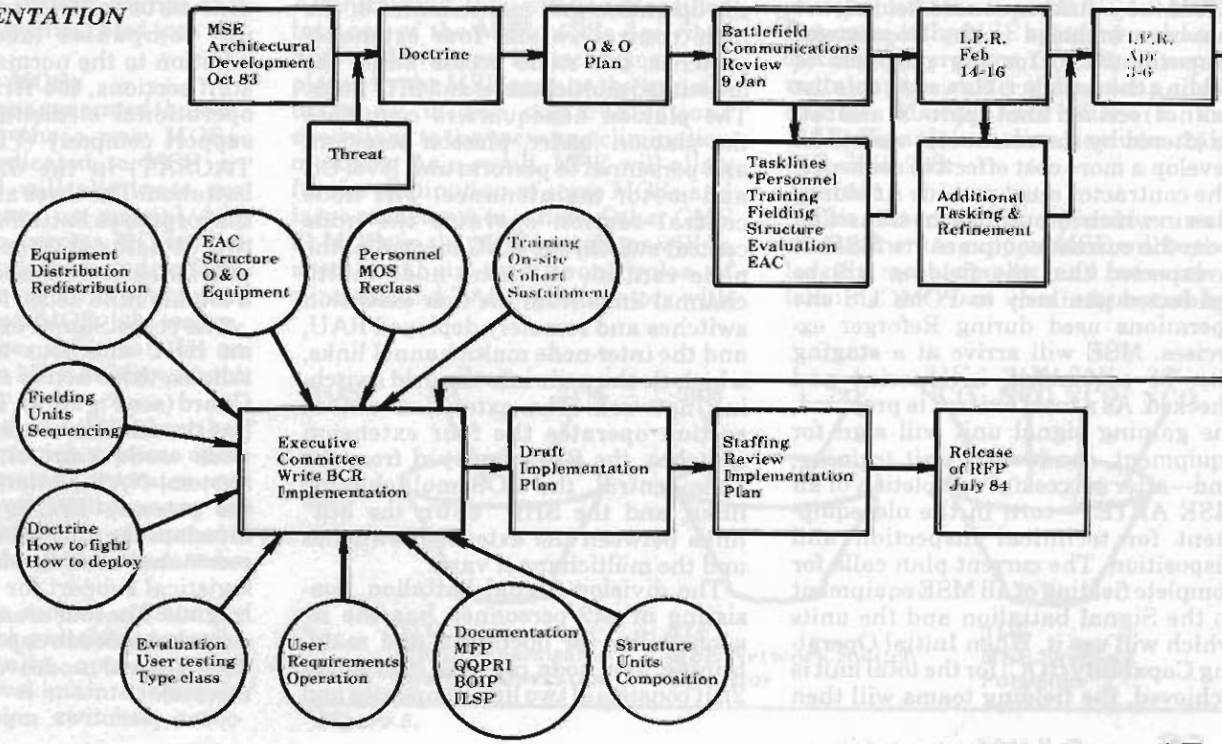
The MSE acquisition process is nontraditional: normal timeliness has been dramatically shortened, and some traditional processes are being eliminated; it should not come as a surprise that the approaches to fielding, structure,personnel and training aren't "business as usual."

The introduction of MSE into the Airland Battlefield will be the most intensive force modernization action yet envisioned. It totally integrates the command and control structure at corps and below, reorganizes and reequips Signal units, places Reserve component units in the same generation as their active counterparts and totally reorients the manner of doing command and control functions.

Fielding

MSE fielding will be accomplished in a manner which departs dramatically from the current methods of introducing force modernization equipment to the field. The fielding, as directed by the Vice Chief of Staff of the Army and the Senior Army Leadership will begin in 1988 and terminate in 1992. MSE is being procured, as a system, and it will be fielded as a system; further, it will be fielded to entire organizations as they now exist on the ground. Each of our

MSE IMPLEMENTATION



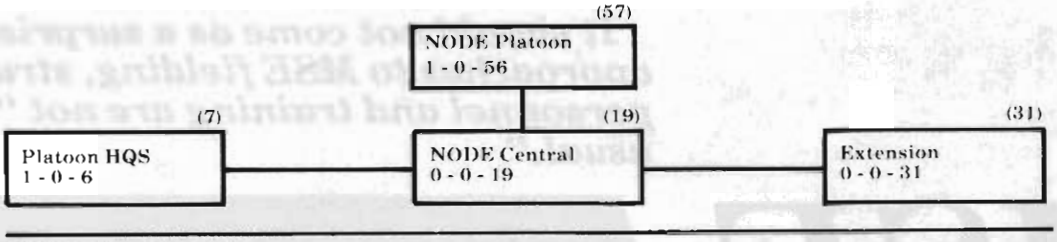


Figure 1. Node platoon

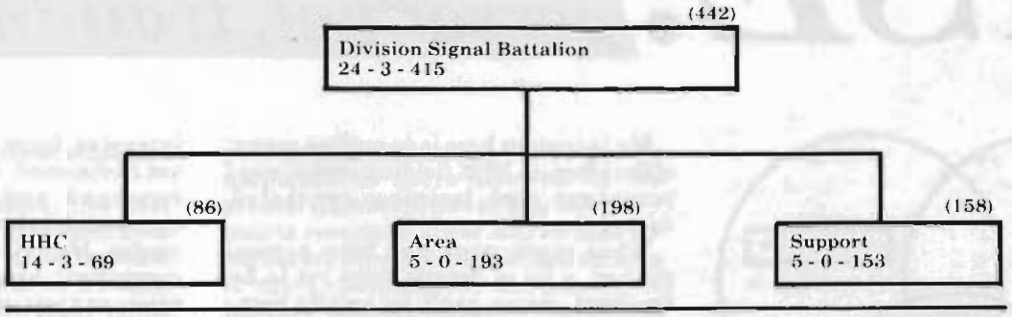


Figure 2. Division Signal Battalion

five corps—reserve as well as active elements—will be fielded in a one year period, including associated divisions, corps troop units, and corps support units. The objective plan calls for fielding a corps and its associated five division force each year for a total AC/RC fielding of five corps/25 divisions. The initial corps—now designated as the III Corps at Fort Hood—is programmed for MSE fielding in 1988. During fielding, there may be some deviations from a pure division/corps alignment as the sequence has been tempered by geographic contingency plans, equipment availability and personnel considerations.

A unit-by-unit sequenced fielding list has been included in the Request for Proposal (RFP) for the purposes of bidding the contract. However, this list has not received final approval and can be altered by the contractor should he develop a more cost effective sequence. The contractor must provide a fielding plan in which he outlines the transition from the current equipment to MSE. It is expected that the fielding will be conducted similarly to POMCUS site operations used during Reforger exercises. MSE will arrive at a staging site, be assembled, inventoried and checked. As a total unit set is prepared, the gaining signal unit will sign for equipment, conduct its unit training, and—after successful completion of an MSE ARTEP—turn in the old equipment for technical inspection and disposition. The current plan calls for complete fielding of all MSE equipment to the Signal battalion and the units which will use it. When Initial Operating Capability (IOC) for the total unit is achieved, the fielding teams will then move to the next sequenced unit. The staging of equipment in this manner will minimize the turbulence normally associated with fielding new equipment.

Structure

As a result of MSE fielding, the division Signal battalion and the corps Signal brigade will undergo a complete TOE revision. It was the goal of the structure developers to provide a TOE which has organizational symmetry and can be applied at both division and corps.

The operational heart of the MSE system is the node platoon (see figure 1). This 57-man team is responsible for the operation and maintenance of the node control switch, four extension switches, two radio access units, the associated multichannel and SHF links. The platoon headquarters comprises the platoon leader, platoon sergeant, and personnel to perform unit level CE and motor maintenance. The node central section operates the node central switch, the RAU located at the node central, the intra-node multichannel links from the four extension switches and remotely deployed RAU, and the inter-node multichannel links, which tie the node into the grid switching network. The extension switch section operates the four extension switches, the RAU deployed from the node central, the LOS multichannel links; and the SHF "down the hill" links between the extension switches and the multichannel vans.

The division Signal battalion, consisting of 442 personnel, has the responsibility for operating and maintaining four node centrals (See figure 2). It consists of two line companies and the HHC.

The HHC contains battalion and company headquarters, battalion staff, operations/intelligence sections and the C&E and motor maintenance sections. A team from the operations section has the responsibility for operating the node central control when the division is independently deployed. The area Signal company consists of the company headquarters and three node platoons described above. The Signal support company has the fourth divisional node platoon, the PLRS/JTIDS and TACSAT sections, and the divisional cable/wire teams.

The corp area Signal battalion consists of an HHC and three area Signal companies (see figure 3). In addition to the normal command and staff sections, the HHC has the same operational elements as the Signal support company (PLRS/JTIDS and TACSAT) in the division's Signal battalion. The three area companies in the corps area battalion are identical to the divisional area company and provide each corps area battalion with a total of nine nodes for deployment.

The corps Signal brigade consists of an HHC and four area Signal battalions, three active and one National Guard (see Figure 4). The brigade HHC has the mission of operating the corps-wide node control, the TACSAT System, NATO interface devices and the gateway TYC-39 switches which interface the EAC. It also provides the command, control, administrative and logistical support for the corps Signal brigade. The four area battalions in the corps brigade are capable of deploying 36 identical nodes (27 active, nine reserve).

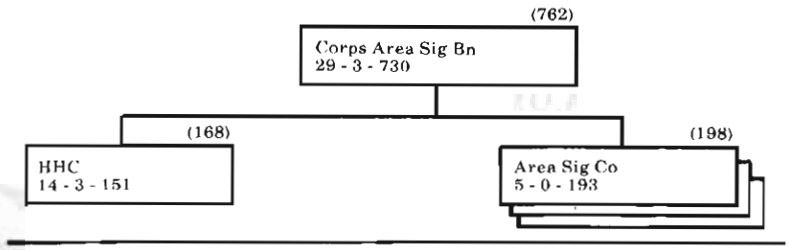


Figure 3. Corps Area Battalion

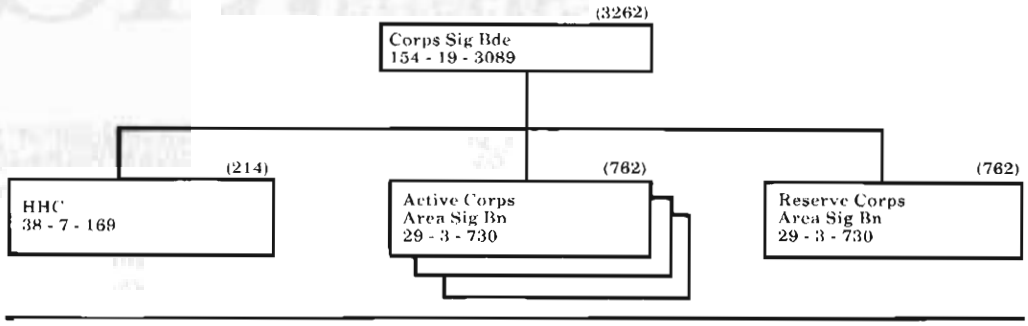


Figure 4. Corps Brigade

Structure conclusions

Using the node platoon as the basic building unit in the structure with a multiple of three—three nodes to an area company, three area companies to a battalion, and three active area battalions to a brigade—a modular TOE that insures symmetry and compatibility has been achieved.

The National Guard MSE division Signal battalion and corps area battalions are identical in equipment and personnel to the active force. This will alleviate many of the peacetime training and logistical constraints, and during hostilities, it will provide to the total force, a reserve Signal unit which can be easily integrated into the battle.

Personnel: new MOSs

CMF 31: MSE has generated the need for establishing three new MOSs. These will be dedicated to MSE organizations and will eliminate our current dependence on special/ASI training added to current MOSs. The skills necessary to operate and perform unit maintenance on MSE equipment cut across current MOS job responsibilities; therefore, there can be no clean transition to MSE MOSs without training.

MOS 31D: The mobile subscriber equipment transmission systems operator supervises, installs, operates and performs unit level maintenance on MSE radio transmission equipment, radio access units (RAU), and radio links.

MOS 31F: The mobile subscriber equipment network switching operator supervises, installs, operates and performs unit level maintenance on node and extension switches, associated multiplexing, Net Radio Interface equipment, and COMSEC devices.

Both of these MOSs will be capped by MOS 31W, MSE Foreman, at E7. This provides the MSE platoons selected staff positions with a home grown MSE-trained NCO having concentrated knowledge in all areas of MSE. The required actions to formalize the new MOS in CMF 31 were submitted for DA, MACOM staffing in April 84.

During the fielding of MSE, selected operator personnel now serving in division and corps Signal battalions will be receiving the high-tech, state-of-the-art MSE training (see figure 5). After training, they will be reclassified into one of the MSE MOSs described above. Advances in technology employed by the MSE permits the transfer of many of the communications operations to the users and elimination of others. As a result, MSE will allow for the elimination of some MOSs and large reductions in others. Other CMF 31 MOSs in the MSE battalions will be used in their traditional roles of wireman and TACSAT operators with little or no additional training.

In the user units, operation of the MSRT, telephones, HF radios and TacFax will become common duties for all unit personnel as a general purpose user (GPU). Assumption of these duties by the GPU will permit the elimination of many of the dedicated positions for Signal personnel in the combat, combat support and combat service support units equipped with MSE. MOS 31V will remain the unit level maintainer on items of user equipment.

CMF 29

There are no current plans to create specific maintenance MOSs for MSE. However, if the MSE system purchased dictates divergence from traditional maintenance skills, these plans could change. Maintenance MOSs in the MSE Signal battalion include: 26L, 31E, 36H, 29S.

Training

The training of operators and maintainers to support MSE will be the largest, most complex, and innovative training program ever attempted by

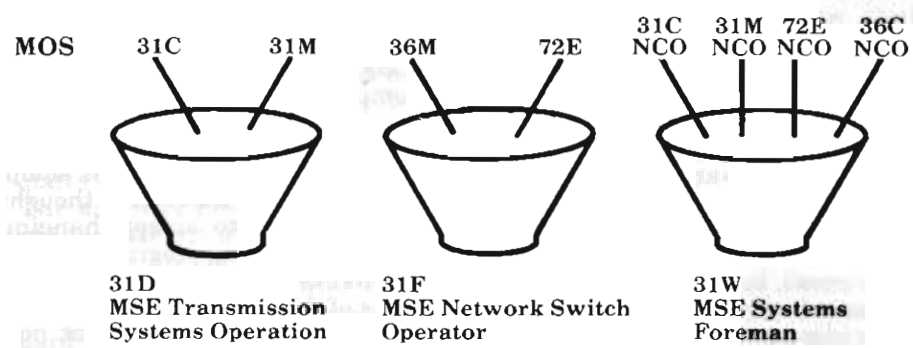


Figure 5.

the Signal Corps. Over the five fielding years of MSE, this program will in some manner involve over 100,000 enlisted, warrant officers and officers in both active and reserve components in Signal and non-Signal user units.

The training for MSE will include both resident and non-resident classroom instruction and exportable multimedia training packages. The training program must include provisions for Signal units and using units, and since MSE is a totally new way of communicating on the battlefield, staffs, planners and commanders must receive the training necessary to execute the communications mission in support of the Airland Battle.

In order to capitalize on the training expertise of civilian industry, the MSE request for proposal requires each bidder to prepare a plan to conduct initial unit training during each fielding year. The bidder must also propose a plan to conduct the resident training course-by-course for specific periods. This plan must also include a method to transition to "green suit" resident training. This detailed contractor developed training plan will compliment and support the materiel fielding plan.

During the MSE IPR, many types of training strategies were paneled. Advantages and disadvantages of each plan were discussed and noted. The results of the training IPR panel will be applied against the contractor's proposals in developing a training strategy which will best provide a totally trained force with minimum disruption of the commander's C^3.

Under present BCR plans, all Reserve Component corps Signal battalions corps and below belong to the Army National Guard (ARNG). Therefore, only the ARNG is scheduled to receive MSE equipment. The receipt of the new equipment will be a unit improvement, but if the corresponding training vehicle is not made available, unit readiness may not improve because of lack of MOS qualification.

MSE training is provided by the contractor planned for the ARNG, but most of these units will be moving from first generation equipment to third generation equipment. Many ARNG personnel do not possess the up-to-date technical skills which make the more advanced equipment specific training premature. A plan to conduct leveler training in the units before the receipt of the new MSE equipment is planned. The Signal Center is presently developing the concept for conducting this leveler training for the ARNG. A concept which will entail a two-year leveler would be completed before the equipment is received and the second year would be hands-on MSE equipment training. The goal is to have a fully qualified battalion at the end of the training cycle.

The specific details of the MSE equipment training for the ARNG are dependent upon the plan provided by the contractor, analyzed and boarded with many of the concepts and recommendations provided by ARNG units, and the IPR panel on NG training strategy.

Conclusions

There have been many accomplishments since the January 5, 1984, go-ahead regarding the implementation of MSE. These actions were completed as a result of dedication and many long hours by military and civilian personnel throughout the Army. MSE has generated a spirit of cooperation among the Signal community and the MACOMs that has no precedence. Much still remains to be accomplished in the compressed time frame between now and the beginning of fielding in 1988. MSE will be the largest buy of communications equipment in history. Innovative thought and willingness to accept changing ways of discharging programmatic requirements are imperative to the success of this initiative.

The spirit of cooperation that now exists must continue, for successful implementation of MSE will restore command confidence in battlefield communications into the 90s.

Since MSE acquisition is a new approach to Army procurements, the logistics system had to be tailored to provide the responsive, effective support required.

MSE: effective logistics support

Since the MSE acquisition is a new approach to Army procurements, the logistics system had to be tailored to provide the responsive, effective support required. There were numerous guidelines established during the system definition phase that have had far reaching impacts on the resulting MSE system and logistics support structure. These guidelines include: to obtain initial MSE capability as quickly as possible, to maximize the use of existing equipment, to reduce the number of Signal soldiers, to meet mobility requirements, to satisfy the user minimum essential needs and to minimize the acquisition of a non-developmental system with a maximum reliance on the contractor for performance/test results logistical support documentation. This approach means that the normal process of developing a logistics support system will not work.

The standard approach to systems acquisition is to develop the logistics concept during the concept exploration phase and iteratively refine the concept throughout the acquisition cycle. Under this process there are a number of tests and support analyses which take place that provide the data required to develop the logistics support concept. This normal developmental acquisition requires anywhere from seven to ten years before a system is fielded.

In the MSE system acquisition, there will not be time for all of these activities to take place. The approach being taken is to ask the MSE contractors to define the logistics support currently used to support their system. Detailed documentation for logistics support must be provided to the Army for evaluation. The Army will then analyze the recommendation and supporting data to insure that the recommended logistics support concept is feasible and adequate to support the system and make modifications to the contractor proposed logistics support concept as necessary. The Army will then integrate the final MSE logistics support concept into the Army logistics support system. Many factors must be considered during this process of integration. The following discussion of the major factors provides some insight into how the MSE logistics support concept will be developed.

The design of the system: Has the system been designed for high reliability and ease of maintenance? This impacts on the number of maintenance personnel and skills required to maintain the system. Design also affects the supply system in that the number and types of spare parts required to be in stock to support system readiness is dictated by reliability and maintainability.

The recommended maintenance support concept: Is the maintenance support adequate to support the system? This impacts on the maintenance level where repair takes place, location of maintenance personnel, test equipment, and spare parts required to support the system. The proper location of maintenance resources is critical to provide effective and responsive support to the equipment.

The supply support required: Can the required spare parts be supplied to the field? Size, quantity and number of lines stocked, and storage and transportation considerations are critical. There must also be adequate storage facilities for the required spares at all levels of maintenance.

Support and test equipment: What are the support and test equipment requirements of this system? It is important that all support and test equipment be identified and provided at the proper level of maintenance. MSE unique items (special tools and test equipment) will be kept to a minimum as each unique item also requires unique support.

The mobility and transportability of the system: Can the system be used on the highly mobile tactical battlefield, and is it transportable to the battlefield? Can it be deployed by standard C130/C141-B aircraft, Naval/commercial ships in standard configuration on US/host nation railroad systems?

Standardization: Does the system take the advantage of standard equipment where possible (generators, COMSEC, TMDE, for example)? The ability of the system to incorporate standard equipment enhances the supportability of the system significantly.

Based upon an analysis of these factors and other considerations relating to MSE, the Signal Center has developed a preliminary maintenance concept. This concept will be updated when an in-depth analysis is made of the selected system using the data provided by the contractor. The final concept will be developed by the Signal Center in coordination with CECOM, the field and the contractor. The final maintenance concept may have contractor personnel involved down to intermediate level, depending on the recommendations made by the contractor and other operational considerations. All maintenance at the unit level will be performed by Army personnel.

The following maintenance concept has been developed by the Signal Center based upon what is known of several systems that are similar to a MSE system and the three-level maintenance concept described in AR 750-1 dated 15 April 1983.

Unit level maintenance will consist of using built-in-test/built-in-test equipment (BIT/BITE), along with supplemental instructions, to fault-isolate to a line replaceable unit (LRU). If it is a critical LRU (an LRU which when faulty, will cause a system operational mission failure), it will be replaced from running spares. Otherwise, a replacement LRU will be obtained by DX procedures. A LRU in this context may be a module, PCB, cable harness, and so on. Additional minor maintenance, such as replacing fuses or lamps, will also be done by the unit maintainer.

Intermediate direct support (DS) maintenance will consist of fault

isolation beyond the capability of the unit maintainer, removal and replacement of shop replaceable units (SRUs) and LRUs not authorized at the unit level, and repair of LRUs not requiring extensive post maintenance testing. Intermediate direct support facilities will maintain a DX capability. Contact teams will be provided to the unit level as required. LRUs not repairable at DS will be evacuated to GS level.

Intermediate general support (GS) maintenance will consist of repairing LRUs, SRUs and PCBs in support of the supply system. ATE will be used to fault-isolate to the component level and verify the repair. All necessary soldering and adjustments will be accomplished. Additional maintenance beyond the capability of DS will be performed.

Depot maintenance will consist of repairing LRUs, SRUs and PCVs beyond the capability of GS and overhaul and rebuilding of end items. This may be at a military depot or civilian facility.

Army standard equipment used in the MSE system such as trucks or generators will be maintained IAW established doctrine. COMSEC maintenance at the unit level will be limited to a GO/NO-GO determination. When the MSE system is selected, the COMSEC maintenance procedures will be established based on the specific COMSEC utilized.

If MSE is to provide the effective communications support to corps and divisions for which it was designed, then an efficient logistics support system must also be developed. We have described the first step toward providing that logistics system. We still have a long way to go before the system can be established and implemented. The Signal Center will continue to work with all concerned in developing the logistics system that will give total support to this MSE acquisition.

Information in the four MSE articles is based solely on a national MSE system architecture with concepts designed by the United States Army Signal School and does not necessarily reflect the actual hardware solution of the ultimately chosen MSE system.